

# Tsunamis affecting New Caledonia : a catalog from 1875 to 2009 based on field investigations and archive research

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**ABSTRACT:** In order to build a more complete record of the most recent tsunamis in New Caledonia, a field investigation was mandated in April 2008. It identified a total of 18 events, of which 12 had not been previously documented. These results confirm an exposure to a hazard of local origin -with delays sometimes shorter than 30 min. post earthquake- and of regional origin (Vanuatu and Solomon arc). They also indicate an exposure to trans-oceanic tsunamis (Kamchatka 1952, South Chile 1960, Kuril Islands 2006, North Tonga 2009) unknown until today.

## 1 Introduction

New Caledonia, a French archipelago in the Southwest Pacific, is located at the Eastern border of the Australian plate, a few hundred km. from this plate's subduction under the Vanuatu arc. It is composed of a main island, Grande-Terre, and the 3 Loyalty Islands located on the eastern side of Grande-Terre.

The event that occurred at the Loyalty Islands on March 28, 1875 is the only recorded tsunami of local origin that has caused casualties in the territory (Louat & Baldassari 1989). This event and a few others are documented in literature: an event which possibly occurred in northern Ouvéa in 1951 and 3 events on the coast of Grande-Terre in 1931 and 1934 (Soloviev & Go 1974).

In 2008, field research was mandated by the French Secretary of State for Overseas Territories in order to establish an exhaustive list of the events which had an impact on the territory.

## 2 Methods

A list of tsunamis that potentially had an impact on the territory, as well as a list of potential tsunamigenic earthquakes, was constructed from previous catalogs (Heck 1947, Soloviev & Go 1974, Louat & Baldassari 1989 and Dunbar et al. 2008).

Previously-recorded testimonies were identified, particularly from the Institut de Recherche pour le Développement (IRD) of Nouméa. Following a widely broadcasted call for witnesses, a field investigation was conducted, focusing on individual meetings and discussions with the elders who lived along the shores at the time of past events. Only people who had a certain knowledge of the sea were considered.

The testimonies were then cross-checked with the

pre-established list of events and weather archives, as well as newspapers and administrative archives, to validate or invalidate the occurrence of tsunamis.

## 3 Results

18 events were identified and documented, of which 12 had not been previously assessed. Figure 1 illustrates the location of the sources when they were precisely identified.

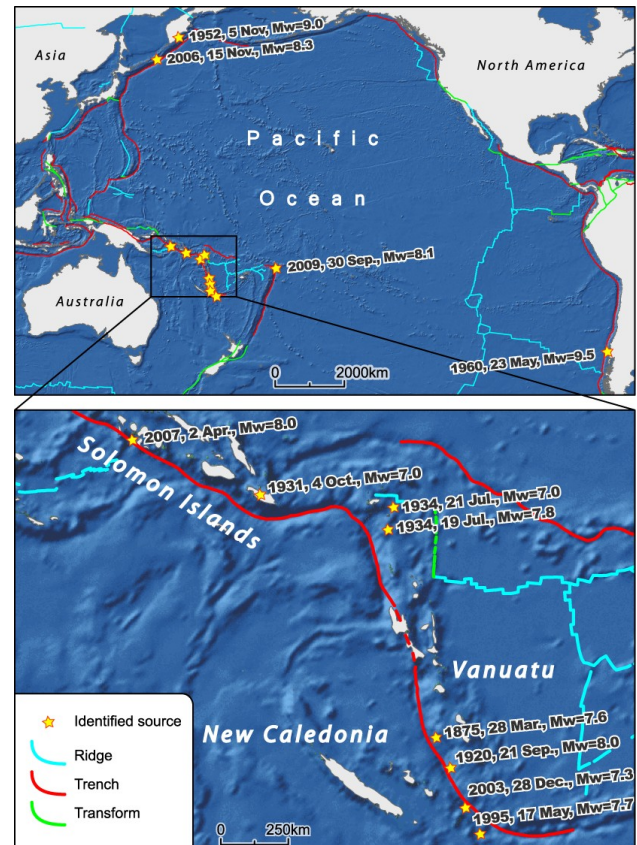


Figure 1. Location of the identified sources.

### 3.1 *Tsunamis of local origin*

4 of these 18 tsunamis have their sources located a few hundred km. away from New Caledonia, in the southern part of the Vanuatu subduction zone (Fig. 1).

The 1875 tsunami is the only one known to have caused deaths, killing 25 people in Lifou (Louat & Baldassari 1989). Oral transmission and ruins of buildings from the tsunami helped determine the measurement of a minimal 2.5m. runup.

The 1920 tsunami flooded Ouvéa, but did not cause any deaths. The two most recent ones caused water disturbances noticed by the Maré police, without causing any damage. These tsunamis affected New Caledonia in a minimal delay of 20min post earthquake.

### 3.2 *Tsunamis of regional origin*

These tsunamis have their sources along the Solomon Islands and on the northern part of the Vanuatu subduction zones (Fig. 1).

Based on literature (Kellar 1935 in Soloviev & Go 1974) and newspaper archives, the affected areas of the 1931 and 1934 tsunamis are documented as being concentrated on the northeast coast of Grande-Terre. Damages are limited to boats and sea walls. No important flood or loss of human life is reported, however, the wave amplifications at the mouth of the rivers are important.

The 2007 tsunami is the most documented one, with a total of 18 witnesses describing the effects of the tsunami along the northeast coast of Grande-Terre and along the Loyalty Islands shores. River mouths are still the places where the greatest signal amplifications are recorded. A 2m. runup is measured. These tsunamis affected New Caledonia in a minimal delay of 1hr20 post earthquake.

### 3.3 *Trans-oceanic tsunamis*

These tsunamis mostly affected the southeastern coast of Grande Terre. While the 1952 and 2006 events only generated amplifications in the rivers (alternating upstream and downstream), the 1960 transoceanic tsunami flooded the southeastern coastal roads of Grande-Terre.

No field investigation was carried out after the 2009 Samoan tsunami, but preliminary research reports a flood over a bridge and alternating currents on the Ouinné River, located southeast Grande Terre.

### 3.4 *Tsunamis of unspecified origins (most likely local or regional)*

6 events, whose sources were not precisely located, are attributable to local landslides or submarine volcanic

eruptions. These events all flooded areas in the Loyalty Islands and/or the eastern coast of Grande-Terre on fair weathered days. Runups were measured, sometimes reaching 2.5m. All these events, as well as their uncertainties, are described and illustrated by Sahal (2010).

## 4 Discussion

The field investigation carried out in 2008 highlights the unexpected impact of tsunamis, including transoceanic tsunamis, on this territory. Many of these impacts were unknown and unexpected by the scientific community.

These results have to be considered carefully since the collection of testimonies involves many limitations: subjectivity of the notion of time, lack of time reference points, risk of mixing events, etc. (Okal et al. 2002).

## 5 Conclusion

This collection of unreleased records completes the existing catalogs with the most recent events. It highlights a hazard which can affect coastal populations in less than 30 minutes. An alert system is being developed in New Caledonia, linked with the Pacific Tsunami Warning Center. Such an alert system must include the installation of tide gauges and of a tsunameter between Vanuatu and the Loyalty Islands.

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